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ALBERT JAN KLUYVER
1888 - 1956

During the night of May 13-14, 1956, Dr. A. J. Kluyver, professor of microbiology at the Technical University of Delft, Holland, passed away, stricken suddenly, by a heart attack at the age of almost 68 years.

It is difficult to realize that this great scientist, who has played such an important role in shaping the present day trends in microbiology, is no longer with us.

For those who had the privilege of knowing this great master of science more intimately (and they are many) he will always be remembered as the prototype of nobility of the mind.

His large study above and adjacent to his modest laboratories, along one of the Dutch canals in the small country town of Delft, was far from an "ivory tower." Here, over a period of almost 35 years, people from all over the world were met with a friendly, human understanding of their problems. Seldom would one leave the company of this great and humble man without a feeling of inspiration, encouragement and scientific enthusiasm.

It is infrequent that Nature bestows on one human being a combination of precious gifts as Kluyver possessed. He had an outstanding scientific mind, an inexhaustable capacity and love for work, unexcelled leadership, was an inspiring teacher with a remarkable common sense, friendly, humane, a noble personality, yet with a truly humble mind, never angry, always ready to help others.

Albert Jan Kluyver not only will leave behind him the deep marks which he permanently carved out as scientist, but he will always be remembered as a true friend, a noble, honest human being.

Born June 3rd, 1888, at Breda, Holland, he lived for several years at the University town of Leiden where his father was a mathematics professor. He studied chemical engineering at the Technical University of Delft from 1905-1910 and, from 1910 to 1916, was assistant to Professor Van Iterson in the department of Technical Botany where he obtained his Ph.D. degree in 1914 on a brilliant thesis entitled: "Biochemical sugar determinations."

After a period of 5 years of government service in the tropics, he was appointed in 1921 professor of microbiology at his Alma Mater, as a successor to Dr. M. W. Beyerinck who had reached the retirement age of 70.

Rather than follow in the footsteps of his famous predecessor, Kluyver designed his own research program. His pioneer work and that of his students on the biochemical activity of microorganisms undoubtedly was largely responsible for the general interest of today in this field. Yet, Kluyver considered his microorganisms mainly as (probably) the most simple forms of life, therefore the ones that might be the most profitably used as study objects for life phenomena. He strongly believed that the underlying principles of life learned from his microbes were applicable to the more complex forms of living organisms.

These concepts of unity in biochemistry are clearly illustrated in his most recent book "The Microbe's Contribution to Biology" and are now quite universally accepted.

It is hardly surprising that this great mind which tried to create order whenever a seemingly chaotic condition existed also turned his attention to the field of Taxonomy.

For many years the international yeast collection of the Central Bureau voor Schimmelcultures was housed in his laboratory. Under Dr. Kluyver's direction, extremely important taxonomic studies were conducted aimed at bringing order in the seemingly endless stream of "new" yeast species reaching his laboratories.

His profound knowledge of the vast variety of microbes and their activities was also repeatedly applied. Many contributions from his hand on the problem of taxonomy show the constant interest he had in this branch of bacteriology.

Dr. Kluyver's death will leave a strange emptiness in the hearts of his many friends. He died "with his boots on" at the height of his career. He dreaded retirement which was a way of life he could not appreciate or understand.

Little Holland and the rest of the world have lost a great man.

J. C. Hoogerheide

ALBERT JAN KLUYVER
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BACTERIOLOGICAL NOMENCLATURE AND TAXONOMY

IN MEMORIAM ALBERT JAN KLUYVER

Dr. Albert Jan Kluyver, Professor of General and Applied Microbiology at the "Technische Hogeschool" of Delft, Holland, died at his home in the night of May 13th-14th, 1956.

Professor Kluyver was born in Breda, Holland, on June 3rd, 1888. During 1910-1916 he served as the assistant of G. van Iterson Jr. at the Botany Department of Delft Institute of Technology. Kluyver was awarded the Doctor's degree at the same Institute in 1914. His Doctor's thesis, entitled "Biochemische suikerbepalingen" is a fundamental contribution to our knowledge of the specific action by microorganisms on carbohydrates and of the quantitative analysis of sugar and sugar mixtures by means of yeasts. In 1921 Kluyver was appointed as the successor of M. W. Beijerinck to the Chair of General and Applied Microbiology at Delft Institute of Technology, and on January 18th, 1922, he gave his inaugural address, entitled "Microbiologie en Industrie." The illustrious period of Beijerinck was now followed by the brilliant era of Kluyver, characterized by restless scientific work with cooperation of a great number of pupils from Holland and abroad under the stimulating leadership of a charming and noble personality.

As an excellent academic teacher Kluyver was beloved all over the world. As a scientific educator he was enthusiastic not only for the research worker and the advanced class, but also for the elementary student. He was ever available for consultation and advice. His gently ironic criticism, as well as his benevolent appreciation of successes and helpful discussion of failures, induced in many students the feeling of being meant for a scientific career. As a matter of fact more than thirty Doctor's theses were prepared under the learned guidance of Kluyver.

Exhaustive studies of the early and current literature combined with the continuous and intimate contact with the experimental work done by his numerous co-workers and pupils in the laboratory made Kluyver a brilliant reviewer of the existing knowledge of the biochemical activities of cells and tissues. Of course he was struck by the surprisingly large diversity in the nutritional requirements of microorganisms as well as by the apparently diverse ways in which various microbial types provide for their indispensable energy requirements. This, however, did not hold him back from looking for principles underlying the bewildering picture of the apparently

infinite complexity of the very different forms of life. Accordingly, he presented the concepts of the "Unity in biochemistry" and the "Comparative biochemistry and physiology" in a great number of excellent lectures and reviews, e.g. "Eenheid en verscheidenheid in de stofwisseling der microben" (1924), "De eenheid in het chemisme van de fermentatieve suikerdissimilatieprocessen der microben" (1924; with H.J.L. Donker), "De katalytische overdracht van waterstof als kern van het chemisme der dissimilatieprocessen" (1925; with H.J.L. Donker), "Die Einheit in der Biochemie (1926; with H.J.L. Donker), "Atmung, Gärung und Synthese in ihrer gegenseitigen Abhängigkeit" (1930), "The Chemical Activities of Microorganisms" (1931; lectures before the University of London in 1930), "Mikrobenstoffwechsel und allgemeine Biologie" (1933), "Tre Aartiers Fremskridt i Mikrobiologi" (1946; lecture before "Danmarks Naturvidenskabelige Samfund" and "Biologisk Selskab" in 1946 when he was awarded the "Emil Christian Hansen Medal"), "Eenige belangwekkende uitkomsten verkregen bij de toepassing van isotopen in het stofwisselingsonderzoek" (1947; lecture before the "Nederlandsche Vereeniging voor Biochemie" in 1946), "The Changing Appraisal of the Microbe" (1953; Leeuwenhoek Lecture before the Royal Society in 1952), and "The Microbe's Contribution to Biology" (1956; with C.B. van Niel; John M. Prather Lectures at Harvard University in 1954). In these and other lectures and publications Kluyver repeatedly drew attention to the fact that the whole of microbial metabolism can be reduced to chains of elementary reactions belonging to a rather small number of types, e.g. transhydrogenation, transphosphorylation, transamination, transsulfuration, transacetylation and transmethylation, in which hydrogen or special groups are split off from one molecule and transferred to a second one. He also very early realized the significance of the phosphorylated energy-rich organic compounds in their capacity to act as material links between the energy-yielding dissimilatory processes (catabolism) and the energy-requiring assimilatory processes (anabolism). Further, Kluyver very soon after the discovery of carbon dioxide reduction by methane bacteria (C. B. van Niel, H. A. Barker) and carbon dioxide assimilation by heterotrophic cells (K. T. Wieringa, H. G. Wood and C. H. Werkman) perceived the far-reaching consequences of this discovery for the classical idea of a rational carbon cycle in nature, in which the photoautotrophic green plants and a few chemoautotrophic bacteria assimilate carbon dioxide and convert it into complex organic compounds.

They thus lift the carbon from the inorganic level to the organic one, while the heterotrophic cells of living animals and most microorganisms mineralize these compounds in their dissimilation processes, thus returning the carbon to the carbon dioxide state. Kluyver has also considered two further aspects of the discovery of heterotrophic carbon dioxide assimilation, namely, on one hand, its importance for our insight into the actively metabolizing cells as systems in which simultaneously a vast number of reversible equilibrium reactions are going on, and on the other hand its significance for the interpretation of dissimilation processes in which the products formed consist of molecules larger than those serving as a substrate. In a lecture given in Helsinki in 1939, published as an article entitled "Die Kohlensäure im Stoffwechsel der Lebewesen" (1939), Kluyver expressed himself on the significance of carbon dioxide as a requisite for all living cells in the following sentence: "Während Plinius sie bald nach dem Anfange unserer Zeitrechnung als '_spiritus letalis_' deutete, liegt, angesichts der ans Licht getretenen Unentbehrlichkeit dieses Gases für alles was lebt, vielmehr Grund vor, ihr den Namen zu schenken von '_spiritus vitalis_'." The fertilizing influence exerted by this brilliant lecture on the biochemical approach to the problem of heterotrophic carbon dioxide assimilation has been generally acknowledged. In a review published in 1941 under the title "Spiritus Vitalis" (Chronica Botanica, 6:337-342) Foster, Carson and Ruben confirm this by the following statement: "To the eminent Dutch microbiologist, A. J. Kluyver, goes the credit for being the first to present an integrated picture of our existing knowledge of the participation of CO_2 in metabolism, especially from the standpoint of comparative biochemistry."

Professor Kluyver has declared: "....since Pasteur's startling discoveries of the important role played by microbes in human affairs, microbiology as a science has always suffered from its eminently practical implications. By far the majority of the microbiological studies were undertaken to answer questions either directly or indirectly connected with the well-being of mankind" (p. 2 in "The Microbe's Contribution to Biology", Harvard University Press, 1956). Nevertheless, he did not forget that he was the second tenant of a Chair of General and Applied Microbiology, founded for the industrial microbiologist Beijerinck at an Institute of Technology. Kluyver was fully aware of the practical aspects of microbiology and we would do injustice to him if we did not take notice

of his fundamental contributions to this field. Among these are to be found reviews, e.g. "Microbiologie en Industrie" (1922; inaugural address) and "Microbial Metabolism and its Industrial Implications" (1952) as well as original works in cooperation with numerous pupils, e.g. on acetic acid bacteria (with F.J.G. de Leeuw and F. Visser't Hooft), lactic acid bacteria (with H.J.L. Donker, C. B. van Niel and H. G. Derx), yeasts (with H.J.L. Donker, F. Visser't Hooft, A. P. Struyk, J. C. Hoogerheide, M. Th. J. Custers and J. P. van der Walt), and molds forming gluconic, citric and kojic acid (with L. H. C. Perquin). Further, Kluyver and his collaborators have made outstanding contributions to our knowledge of the propionic acid fermentation (C. B. van Niel), methane fermentation (C. B. van Niel, H. A. Barker and Ch. G. T. P. Schnellen), butyric acid and acetone-isopropyl alcohol-butyl alcohol fermentation (H. J. L. Donker and J. B. van der Lek), the Coli type of fermentation (E. L. Molt and M. A. Scheffer), bacterial sulfate reduction (J. K. Baars and R. L. Starkey) and nitrate reduction (W. Verhoeven), nitrifying bacteria (T. Y. Kingma Boltjes), sulfur bacteria (C.B. van Niel, F.M. Muller and P.A. Roelofsen), and luminous bacteria (K. L. van Schouwenburg), the cellulose-decomposing bacteria in the rumen of cattle (A. K. Sijpesteijn), the "Tibi-Konsortium" (H.D. Mayer), microbial amylases (F.A.M.J. van Waesberghe), the oxidation-reduction potentials in cultures of bacteria and yeasts (B. Elema, J. W. van Dalfsen and J. C. Hoogerheide) and the Pasteur-Meyerhof effect (J. C. Hoogerheide and M. Th. J. Custers), etc., etc. Through these and other works, done by the "Delft School" under the encouraging and stimulating leadership of Kluyver, a great many occupants of professorial chairs in Holland and abroad and holders of other academic as well as eminent governmental and industrial positions obtained a solid training in biochemical and microbiological techniques and simultaneously a thorough insight into the marked diversity in the chemical manifestations of life and the general principles underlying the highly different ways in which living cells provide for their energy and nutritional requirements.

Although Kluyver's tastes and training were mainly those of a biochemist and physiologist he paid due attention to the problems of taxonomy and nomenclature of microorganisms, particularly of bacteria and yeasts (partly with C.B. van Niel). He was a member and chairman of the International Committee on Bacteriological Nomenclature of the International Association of Microbiologists and a member of its Judicial Commission.

Kluyver also emphasized the adequacy of biochemical and physiological microbiology to devise fruitful approaches to the mechanisms of the transition of nonliving organic matter to living organisms as well as to those of heredity and evolution.

In the course of the thirty-five years, during which Kluyver directed the work at "Laboratorium voor Microbiologie te Delft", he received numerous distinctions. Thus honorary degrees were conferred upon him by Iowa State College, Louvain University, Rutgers University and Swiss Federal Institute of Technology. He was elected to membership in the Netherland's Koninklijke Akademie van Wetenschappen. The Finnish and Royal Flemish Academies of Sciences made him a Foreign Member. He became a Foreign Associate of the National Academy of Sciences (Washington, D. C.) and an Honorary Foreign Member of the American Academy of Arts and Sciences. Further, he was elected a Foreign Member of the Royal Society and an Honorary Member of the British Society for General Microbiology, of New York Academy of Sciences and of the Society of American Bacteriologists. In Denmark he received the "Emil Christian Hansen Medal" and in England the "Copley Medal" of the Royal Society.

Numerous pupils, scattered all over the world, will ever remember Kluyver not only as a critical and stimulating scientist of strong responsibility and receptivity and with enormous experience and capacity for work, but also as a noble and charming personality of great benevolence giving moral support and evoking enthusiasm, intellectual admiration, deep affection and veneration. He was something of a Confucian gentleman without flaw and without reproach.

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September 24th, 1956

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TAXONOMIC NOTES

Taxonomic Significance of the Chemical Composition of the Cell Wall in Gram-positive Bacteria.

Cummins and Harris[1] harvested pure cultures of various Gram-positive bacteria and mechanically disintegrated the cells. By digestion with trypsin, ribonuclease and pepsin, washing, and centrifugation, the bacterial cell walls were prepared for hydrolysis and determination of sugars, of amino acids and of hexosamines by chromatography.

"A very high proportion of the amino-acid moiety of the cell-wall complex could in each case be accounted for in terms of 3 or 4 of the amino acids alanine, glutamic acid, lysine, diaminopimelic acid, aspartic acid and glycine. In general each bacterial genus appears to have a characteristic pattern of cell-wall components, particularly in regard to the amino acids present. Variations in the relative proportions of the sugar appear to differentiate the individual species within a genus."

Streptococcus. Seven Lancefield groups.
Amino acids: Alanine +; glutamic acid +; lysine +.
Amino sugars: Glucosamine +; unidentified hexosamine +; galactosamine + in four, - in three.
Sugars: Rhamnose +; arabinose - ; galactose, glucose and mannose variable.

Corynebacterium. C. diphtheriae, C. ulcerans, C. ovis, C. xerosis, C. hofmanni, C. renale, C. equi and C. murium.
Amino acids: Alanine +; glutamic acid +; diaminopimelic acid +.
Amino sugars: Glucosamine +; unidentified hexosamine +; galactosamine + in C. hofmanni, C. renale and C. murium.
Sugars: Arabinose +; galactose +; mannose + or trace; rhamnose + in C. murium; glucose + in C. ovis, C. hofmanni, C. renale and C. murium.

[1]Cummins, C. S. and H. Harris. The chemical composition of the cell wall in some Gram-positive bacteria and its possible value as a taxonomic character. Jour. Gen. Microbiol. 14 (3): 583-600. 1956.

C. pyogenes (6 strains) and C. haemolyticum (1 strain) gave a different picture.
Amino acids: Alanine +; glutamic acid +; lysine +; diaminopimelic acid +.
Amino sugars: Glucosamine +; unidentified hexosamine +; galactosamine +.
Sugars: Rhamnose +; arabinose - ; galactose - ; glucose + in C. pyogenes, - in C. haemolyticum.

C. pyogenes and C. haemolyticum from the standpoint of cell-wall composition warrant their removal from the genus Corynebacterium and inclusion in Streptococcus. These species are catalase - , the other species of Corynebacterium are catalase +.

Lactobacillus. L. sp. (from yoghurt), L. acidophilus, L. helveticus, L. fermenti, L. brevis, L. casei, L. delbrueckii.
Amino acids: Aspartic acid +; alanine +; glutamic acid +; lysine +; diaminopimelic acid - .
Amino sugars: Glucosamine +; unidentified hexosamine +; galactosamine + in L. casei and L. delbrueckii, - in others.
Sugars: Glucose +; rhamnose + in L. casei and L. delbrueckii, - in others; galactose + in L. fermenti, L. casei, L. delbrueckii.

L. plantarum (4 strains).
Amino acids: Aspartic acid - ; alanine +; glutamic acid +; lysine - ; diaminopimelic acid +.
Amino sugars: Glucosamine +; unidentified hexosamine +; galactosamine - .
Sugars: Arabinose - (or trace); glucose + (2), - (2).

The amino acid pattern in these strains is quite different from that of the other lactobacilli examined, and is in fact identical with the pattern found in Corynebacterium. However, they differ from species of Corynebacterium in that none contain arabinose as a major constituent.

Aerococcus. A. viridans (4 strains).
Amino acids: Alanine +; glutamic acid +; lysine +; diaminopimelic acid - ; glycine - ; aspartic acid -.
Amino sugars: Glucosamine +; galactosamine +; unidentified hexasamine +.

Sugars: Arabinose - ; rhamnose - ; galactose + (2 strains), - (2 strains); glucose +; mannose ±.

These strains differ from Streptococcus in not containing rhamnose and from Staphylococcus in containing no glycine.

Micrococcus. M. rhodochrous and M. cinnabareus.
Amino acids: Alanine +; glutamic acid +; lysine - ; diaminopimelic acid +; glycine - .
Amino sugars: Glucosamine +; galactosamine +; unidentified hexosamine +.
Sugars: Arabinose +; rhamnose - ; galactose +; glucose - .

The cell-wall composition indicates that these species should be allocated to the genus Corynebacterium, confirming the previous rejection from the genus Micrococcus by Shaw, Stilt and Cowan (1951) on morphological grounds.

Staphylococcus. S. aureus, S. albus.
Amino acids: Alanine +; glutamic acid +; lysine +; serine trace; glycine +.
Amino sugars: Glucosamine +; galactosamine - ; unidentified hexosamine +.
Sugars: Arabinose -; rhamnose -; galactose -; glucose -; mannose - .

Staphylococcus citreus, Micrococcus luteus and Sarcina lutea differ from the preceding in having glucose +.

Problem of Classification of the Halophilic Bacteria.

Flannery[1] in his review of our knowledge of the halophilic bacteria states that halophiles isolated from hides, fish and salt have been placed by various authors in the following bacterial genera: Actinomyces, Corynebacterium, Proteus, Nitrosomonas, Vibrio, Pseudomonas, Flavobacterium and Achromobacter. Note is taken of the proposal by Sturges and Heidman, Spruit and Pijper (1952), of the generic name Halobacterium for rods isolated from salt or salted products, growing in

[1]Flannery, William L. Current status of knowledge of halophilic bacteria. Bact. Rev. 20 (2):49-66. 1956.

not less than 12 per cent salt media and having a red carotinoid pigment. It is concluded that "The formulation of a new tribe (as Halophileae Sturges 1923) or genus based on halophilism cannot be recommended at this time, for this action would create a respository for a conglomeration of many different organisms whose only relationship would be their halophilic character."

INTERNATIONAL BULLETIN OF BACTERIOLOGICAL NOMENCLATURE AND TAXONOMY
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NOMINA NOVA BACTERIORUM

New Names of Taxa and of New Combinations in Bacteriology and Virology

(Nomina Nova et Combinationes Novae)

Editorial Board

Suggestions have been made that there be maintained by the International Committee on Bacteriological Nomenclature through its Judicial Commission and Board of Editors an official registry of new names of taxa and of new combinations proposed in bacteriology and virology. It has even been suggested that new names should be officially "registered" as an additional requirement for valid publication in accordance with the rules of the International Code of Nomenclature of Bacteria and Viruses. Such a drastic provision would probably be inopportune and quite unwise, at least at present.

However, a major problem met by any one who finds it necessary to propose a new name or a new combination in bacteriology is to determine whether the name is a later homonym and therefore probably illegitimate and unsuited to publication. Problems of homonymy are most commonly met with in the names of genera. Generic names proposed in bacteriology may not be later homonyms of names of protozoan or plant genera.

In the field of zoology the Zoological Record has rendered a great service by listing and indexing the new names proposed in the many branches of zoology. One of these lists, that of the Protozoa, is of major interest to bacteriologists in that the legitimate name of no taxon of bacteria may be a later homonym of the name of a protozoan taxon.

The International Bureau for Plant Taxonomy and Nomenclature has in preparation a card catalog of the names of genera that have been validly published. When this is complete it will constitute an invaluable source of reference for both botanists and bacteriologists. It will include also a list of validly published names of bacterial genera.

The systematic index of Biological Abstracts is also useful, but not as complete as might be wished. However, even yet the annual indexes are scarcely current.

A notable source of information relative to published names of bacterial taxa will be the forthcoming Index Bergeyana.

Dr. R. S. Breed, Chairman of the Board of Editors of Bergey's Manual of Determinative Bacteriology, before his death, had brought together a list of thousands of names of bacterial taxa, and, as far as possible, indicated synonymy. This list will require some editing, but will presently be published under the auspices of the Bergey Trust. However, in the compilation of this comprehensive list it is not practicable to indicate which names have been validly published, and which of the latter are legitimate (not contrary to a rule) or correct (a name which must under the rules be adopted for the name of a taxon with a particular circumscription, position and rank). Its index of names of taxa and of epithets with the accompanying citations to literature will constitute a mine of source material.

However, it is clear that none of the above aids fully meet the needs of bacteriologists. There is a place for a cumulative index to the names of bacterial taxa as they are found in the current literature. And the list of validly published generic names should be completed and kept up to date.

It is proposed therefore, to print regularly in this BULLETIN the names of genera and species that have been published. New names of taxa will be listed quarterly in the BULLETIN under the above heading. Here will be included the new names proposed for the higher taxa, for genera and subgenera, for species, subspecies and the subdivisions of the latter. As far as possible allocation of genera to higher taxa will be noted. The etymology of the names will be given if this is determinable. For names derived from the Greek the latinized transliteration will be given rather than the original Greek. The type species of genera will be indicated where this is ascertainable, also the location of the type culture if this has been deposited in a type culture collection. Probable validity of publication may be noted, particularly where this is doubtful.

NEW NAMES OF SUPRAGENERIC TAXA OF BACTERIA AND VIRUSES

Ehrlichieae Philip, 1953. (Suggested as a name for a tribe of the family Rickettsiaceae.)
Plural feminine noun (adjectival in form).
Etymology: from the generic name Ehrlichia.

Type genus Ehrlichia (Moshkovsky) Moshkovsky, 1945. The author states "It would seem more rational, at present, for those desiring suprageneric groupings to place...Ehrlichia and Cowdria in a tribe Ehrlichieae." Apparently the name was not validly published because it was not accepted by the author, and because it was accompanied by no description of the taxon. (Rules 12a and 12e Bacteriological Code).

Philip, Cornelius B. Nomenclature of the Rickettseaceae pathogenic to vertebrates. Annals of the New York Acad. Sci. 56:484-494 (p. 486). 1953.

Ehrlichieae Philip, 1956. (Proposed as the name of the second tribe of the family Rickettsiaceae. The suggestion of the preceding is here made a proposal.) The author states "Two of the proposed tribes were previously anticipated I. Rickettsieae...and II. Ehrlichieae."

Three genera are included: Ehrlichia (Moshkovsky) Moshkovsky, 1946; Cowdria (Moshkovsky) Moshkovsky, 1947; and Neorickettsia Philip, Hadlow and Hughes. Apparently the name was not validly published, as no description or reference to a description of the taxon is given. (Rule 12 Bacteriological Code).

The name will be validly published in Bergey's Manual, seventh edition, now in press (personal communication).

Philip, Cornelius B. Comments on the classification of the order Rickettsiales. Can. Journ. Microbiol. 2:261-270 (p. 262). 1956.

Microtatobiotes Philip, 1956. This is proposed as the name of a new class of the new division Protophyta to appear in the seventh edition of Bergey's Manual of Determinative Bacteriology. This class is coordinate with the class Schizomycetes.

Pl. fem. adn. Etymology: Greek superlative adj., microtatus smallest,very small,from the Greek adj., micrus small; Greek noun biotus life; modern Latin pl. adj., Microtatobiotes smallest living (things).

Two orders are included, Rickettsiales Buchanan and Buchanan, and Virales Breed, Murray, and Hitchens.

Philip, l.c. (p. 262). 1956.

Rickettsieae Philip, 1953. (Proposed as a name for the first tribe of the family Rickettsiaceae.)
Plural feminine noun. (Adjectival in form.) Etymology: from the generic name Rickettsia.
Type genus Rickettsia da Rocha Lima, 1916.
The author states "It would seem more rational, at present, for those desiring suprageneric groupings here to place Rickettsia and Coxiella in a tribe Rickettsieae."
Apparently the name was not validly published because it was not accepted by the author, and because it was accompanied by no description of the taxon. (Rule 12 Bacteriological Code.)
Philip l.c. (p. 486). 1953.

Rickettsieae Philip, 1956. (Proposed as the name of the first tribe of the family Rickettsiaceae. See preceding. The suggestion made by Philip (1953) above is here made a proposal.)
The author states "Two of the tribes were previously anticipated I. Rickettsiaceae and II. Ehrlichieae."
Two genera are included: Rickettsia da Rocha Lima, 1916, and Coxiella (Phillip) Philip, 1948.
Apparently the name of the taxon was not validly published as there was no description of the taxon (Rule 12 Bacteriological Code).
The name will be validly published in Bergey's Manual, seventh edition, now in press (September 1956).
Philip l.c. (p. 262). 1956.

Wolbachieae Philip, 1956. (Proposed as the third tribe of the family Rickettsiaceae.)
Plural feminine noun. (Adjectival in form). Etymology: from the generic name Wolbachia Hertig, 1936.
Three genera included: Wolbachia Hertig, 1936; Symbiotes Philip, 1956; and Rickettsiella Phillip, 1956.
Type genus, Wolbachia Hertig, 1936.
Philip l.c. (p. 266). 1956.

BACTERIOLOGICAL NOMENCLATURE AND TAXONOMY

NEW NAMES OF GENERA OF BACTERIA

Butyrivibrio Bryant and Small, 1956. (Tribe Spirilleae, Family Pseudomonadaceae).
Masculine noun. Etymology: Latin noun butyrum butter; Modern Latin acidum butyricum butyric acid; Latin verb vibro to shake, vibrate; Modern Latin Vibrio, Vibrionis that which vibrates, a generic name; Modern Latin noun Butyrivibrio butter Vibrio, probably for butyric Vibrio.
From bovine rumen.
Type species: by designation and monotypy, Butyrivibrio fibrisolvens Bryant and Small, 1956.
Bryant, Marvin P. and Nola Small. The anaerobic, monotrichous butyric acid-producing, curved, rod-shaped bacteria of the rumen. Jour. Bact. 72 (1): 16-21 (p. 18). 1956.

Kluyvera Asai, 1956. (Tribe Pseudomonadeae, Family Pseudomonadaceae).
Feminine noun. Etymology: from the name of the microbiologist, Professor A. J. Kluyver.
Distinguished by production of a-ketoglutaric acid, also acid and gas from glucose.
Type species: Kluyvera citrophila Asai, 1956.
Asai, in Asai, Toshinobu, Shini Okumura and Toshinao Tsunoda. On a new genus, Kluyvera. Proc. Japan Acad. 32:488-493 (p. 489). 1956.

Lachnospira Bryant and Small, 1956. (Tribe Spirilleae, Family Pseudomonadaceae).
Feminine noun. Etymology: Greek noun lachnus wool, hair; Greek noun spira a coil or spiral; Modern Latin noun Lachnospira woolly spiral.
From bovine rumen.
Type species: by designation and monotypy, Lachnospira multiparus Bryant and Small, 1956.
Bryant and Small l.c. (p. 24). 1956.

Rickettsiella Phillip, 1956. (Tribe Wolbachieae, Family Rickettsiaceae).
Feminine diminutive noun. Etymology: from the generic name Rickettsia with Latin diminutive ending - ella.

Type species: by designation, Rickettsiella popilliae (Dutky and Gooden) Philip, 1956.
Philip l.c. (p. 267). 1956.

Succinivibrio Bryant and Small, 1956. (Tribe Spirilleae, Family Pseudomonadaceae).
Masculine noun. Etymology: Latin noun succinum amber; Modern Latin acidum succinum succinic acid; Latin verb vibro to shake, vibrate; Modern Latin Vibrio, Vibrionis that which vibrates, a generic name; Modern Latin noun Succinivibrio succinic Vibrio.
From bovine rumen.
Type species: by designation and monotypy, Succinovibrio dextrinosolvens Bryant and Small, 1956.
Bryant and Small l.c. (p. 22). 1956.

Symbiotes Philip, 1956. (Tribe Wolbachieae, Family Rickettsiaceae).
Masculine noun. Etymology: Greek masculine noun symbiotes one who lives with, a companion.
Type species: by designation and monotypy, Symbiotes lectularius (Arkwright, Atkin and Bacot) Philip, 1956.
Philip l.c. (p. 266). 1956.

NEW NAMES OF SUBGENERIC TAXA OF BACTERIA

Albus Baldacci et Grein, 1955. (p. 31).
Diastaticus Baldacci et Grein, 1955. (p. 30).
Griseus Baldacci et Grein, 1955. (p. 31).
Lavendulae Baldacci et Grein, 1955. (p. 32).

Baldacci and Grein have proposed that the genus Actinomyces be divided into four "Series", each bearing as a name the specific epithet of the type genus. Each one of the series is characterized. "Excluding from the concept of form the appendages of the spores (spines, hairs, wrinkles, etc.) we are able to assert that the form of the spores appears constant in all the strains of a determined series....It seems possible to conclude that the characteristic form of the spore cannot serve to determine the species." About 50 strains of the genus were studied. The International Code of Nomenclature of the Bacteria and Viruses (approved at the Inter-

national Microbiological Congress in Rome, 1953) recognizes the subgenus as the only subdivision of the genus, and states that the name should be a noun or an adjective used as a noun. The significance of the term "Series" in bacteriological nomenclature is problematical.

Baldacci, E. and A. Grein. Esame forma delle spore di attinomiceti al microscopio elettronico e loro valutazione ai fini di una classificazione. Giorn. Microbiol. 1:28-34. 1955.

NEW NAMES AND NEW BINOMIAL COMBINATIONS OF NAMES OF BACTERIA

Actinomyces rubrocyanodiastaticus Baldacci, Grein et Spalla, 1955.

Adjective. Etymology: Latin adj. ruber red; Greek adj. cyaneus dark blue, blue; Greek adj. diastaticus separative, dividing, Modern Latin diastatic; in form a single specific epithet in a legitimate binomial combination, in meaning a polynomial, apparently intended to mean the "reddish-blue diastatic Actinomyces."

There is no description of this new species and no reference to a previously published description, validity of publication is questionable. Three varieties are named and described.

There is the statement (p. 140): "A. rubrocyanodiastaticus nobis, comprendente le var. impiger, piger ed atrodiastaticus."

There is no designation of a type culture and its disposition.

Included in the series Diastaticus of the genus Actinomycetes.

Baldacci, E, A. Grein, and Spalla. Studio di una "Serie" di specie di attinomiceti A. diastaticus. Giorn. Microbiologia 1:127-143. 1955.

Actinomyces virido-diastaticus Baldacci, Grein et Spalla, 1955.

Adjective. Etymology: Latin adj. viridis green; Greek adj. diastaticus separative, dividing, Modern Latin diastatic; the name in form is a legitimate binomial combination, in meaning trinomial, appar-

ently intended to mean "the green diastatic Actinomyces."
None of the 21 cultures studied is designated as the type culture.
There is no designation of a type culture collection in which a culture has been deposited.
Is assigned to the series "Diastaticus" in the genus Actinomyces.
Validly published.
Baldacci, Grein and Spalla l.c. (p. 133). 1955.

Butyrivibrio fibrisolvens Bryant et Small, 1956.
Participial adjective. Etymology: Latin noun fibra a fiber; Latin part. adj. solvens dissolving; Modern Latin adj. fibrisolvens fiber-dissolving.
Type species of genus Butyrivibrio.
Type culture deposited in American Type Culture Collection, Washington, D. C., U.S.A.
Type strain produces hydrogen, carbon dioxide, butyric, formic and lactic acids from glucose.
Bryant and Small l.c. (p. 19). 1956.

Kluyvera citrophila Asai, 1956.
Feminine adjective. Etymology: Latin noun citrus the citron tree; Modern Latin Citrus generic name of the lemon; acidum citricum citric acid; Greek adj. philus loving; Modern Latin adj. citrophila citrate loving.
Type species of genus Kluyvera.
Type strain and depository undesignated.
Three varieties are designated as α, β and γ, respectively, but not named.
Asai, in Asai, Okumura and Tsunoda l.c. (p. 489). 1956.

Kluyvera noncitrophila Asai, 1956.
Feminine adjective. Etymology: Latin adverb non not; Modern Latin adj. citrophila citrate loving; Modern Latin adj. noncitrophila not citrate loving.
Type strain and depository not designated.
Asai, in Asai, Okumura and Tsunoda l.c. (p. 491). 1956.

Lachnospira multiparus Bryant et Small, 1956.
Adjective. Etymology: Latin adj. multus many; Latin verb pario to produce, to bear; Modern Latin multiparus bearing many.
Type species of genus Lachnospira. Monotypic.
Type culture deposited in American Type Culture Collection, Washington, D. C., U.S.A.
Type strain produced hydrogen, carbon dioxide, acetic acid, formic acid, lactic acid and ethanol, but not methane, butyric, propionic or succinic acids.
Bryant and Small l.c. (p. 24). 1956.

Rickettsiella popilliae (Dutky et Gooden) Philip, 1956.
Rickettsia popilliae (Rickettsiaceae) Dutky et Gooden, 1951.
Genitive singular of insect generic name Popillia.
Type species of the genus Rickettsiella Philip, 1956.
Causes "Blue disease" of beetle larvae.
Philip l.c. (p. 267). 1956.

Succinivibrio dextrinosolvens Bryant et Small, 1956.
Participial adjective: Etymology: Latin adj. dextra to the right; Modern Latin dextrinum dextrin; Latin part. adj. solvens dissolving; Modern Latin dextrinosolvens dextrin-dissolving.
Type species of genus Succinivibrio.
Type culture deposited in American Type Culture Collection, Washington, D. C., U.S.A.
Type strain produces carbon dioxide, acetic acid, formic acid and lactic acid from glucose.
Bryant and Small l.c. (p. 22). 1956.

Symbiotes lectularius (Arkwright, Atkin et Bacot) Philip, 1956. (Typographical error in original reads S. lectularia.)
Rickettsia lectularia Arkwright, Atkin and Bacot, 1921.
Etymology: Modern Latin adj., the specific epithet of the name of the bedbug, Cimex lectularius; Latin diminutive noun lectulus a couch, a little bed; Modern Latin adj. lectularius of a couch.
Type species of the genus Symbiotes Philip, 1956.
Found in the bedbug (Cimex lectularius).
Philip l.c. (p. 267). 1956.

Wolbachia ctenocephali (Sikora) Philip, 1956.
Rickettsia ctenocephali Sikora, 1918.
Etymology: Genitive singular of name of the insect genus Ctenocephalus.
Philip l.c. (p. 267). 1956.

Wolbachia culicis (Brumpt) Philip, 1956.
Rickettsia culicis Brumpt, 1938.
Etymology: genitive singular of the generic name of the insect genus Culex.
Philip l.c. (p. 267). 1956.

Wolbachia dermacentrophila (Steinhaus) Philip, 1956.
Rickettsia dermacentrophila Steinhaus, 1942.
Etymology: Modern Latin noun Dermacentor name of a genus of ticks; Greek adj. philus loving; Modern Latin adj. dermacentrophila Dermacentor-loving.
Philip l.c. (p. 267). 1956.

Wolbachia linognathi (Hindle) Philip, 1956.
Rickettsia linognathi Hindle, 1921.
Etymology: genitive singular of Linognathus, name of a genus of insects.
Philip l.c. (p. 267). 1956.

Wolbachia melophagi (Nöller) Philip, 1956.
Rickettsia melophagi Nöller.
Etymology: genitive singular of the name of the insect genus Melophagus.
Philip l.c. (p. 267). 1956.

Wolbachia pulex (Macchiavello) Philip, 1956.
Rickettsia pulex Macchiavello, 1939.
Etymology: generic name of an insect, Pulex.
Philip l.c. (p. 267). 1956.

Wolbachia sericea (Giroud et Martin) Philip, 1956.
Rickettsia sericea Giroud and Martin, 1950.
Etymology: Latin adj. sericea silken.
Philip l.c. (p. 267). 1956.

Wolbachia trichodectae (Hindle) Philip, 1956.
Rickettsia trichodectae Hindle.
Etymology: genitive singular of the insect generic

name Trichodectes.
Philip l.c. (p. 267). 1956.

NEW NAMES OF SUBSPECIES AND VARIETIES OF BACTERIA

Actinomyces diastaticus var. ardesiacus Baldacci, Grein et Spalla, 1955.
Adjective. Etymology: "Micelio aereo color ardesia." Type culture not designated, nor depository.
Included in the Series Diastaticus in the genus Actinomyces.
Baldacci, Grein and Spalla l.c. (p. 136). 1955.

Actinomyces diastaticus sensu Waksman et Curtis, 1916.
Made a synonym of Actinomyces diastatochromogenes Krainsky, 1914.
Baldacci, Grein and Spalla l.c. (p. 140). 1955.

Actinomyces griseolus Waksman, 1923.
Actinomyces diastatochromogenes Krainsky, 1914.
Baldacci, Grein and Spalla l.c. (p. 140). 1955.

Actinomyces diastaticus var. lipmanii (Waksman et Curtis) Baldacci, Grein et Spalla, 1956.
Actinomyces lipmanii Waksman et Curtis, 1916, is made a variety of A. diastaticus Krainsky, 1914.
Baldacci, Grein and Spalla l.c. (p. 140). 1955.

Actinomyces diastaticus var. venezuelae (Ehrlich, Gottlieb, Burkholder, Anderson et Pridham) Baldacci, Grein et Spalla, 1956.
Actinomyces venezuelae Ehrlich et al., 1948, is made a variety of Actinomyces diastaticus Krainsky, 1914.
Baldacci, Grein and Spalla l.c. (p. 140). 1955.

Actinomyces rubrocyanodiastaticus var. atrodiastaticus Baldacci, Grein et Spalla, 1956.
Adjective. Etymology: Latin adj. ater black; Greek adj. diastaticus separative, dividing; Modern Latin diastatic; in form atrodiastaticus is a single subspecific epithet in a legitimate combination, in meaning binomial apparently intended to mean the "black diastatic variety of."

No type culture or depository is designated.
The nomenclatural status of an adequately described variety of an undescribed species is uncertain.
The variety is assigned to the Series "Diastaticus" of the genus Actinomyces.
Baldacci, Grein and Spalla l.c. (p. 138). 1955.

Actinomyces rubrocyanodiastaticus var. impiger Baldacci, Grein et Spalla, 1956.
Adjective. Etymology: Latin adj. impiger active, quick.
None of the nine isolates studied is designated as a type culture, and no depository is listed.
The variety is assigned to the Series "Diastaticus" of the genus Actinomyces.
The nomenclatural status of a varietal name in this case in which the name of the species has not been validly published is uncertain. The variety is adequately described.
Baldacci, Grein and Spalla l.c. (p. 136). 1955.

Actinomyces rubrocyanodiastaticus var. piger Baldacci, Grein et Spalla, 1956.
Adjective. Etymology: Latin adj. piger slow, sluggish.
None of the ten isolates studied is designated as a type culture, and no depository is listed.
The variety is assigned to the Series "Diastaticus" of the genus Actinomyces.
The nomenclatural status of a varietal name of an undescribed species is uncertain. The variety is adequately described.
Baldacci, Grein and Spalla l.c. (p. 137). 1955.

Selenomonas ruminantium var. lactilytica Bryant, 1956. (Spirillaceae).
The specific epithet was incorrectly spelled lactilyticas a typographical error (personal communication).
Feminine adjective. Etymology: Latin noun lac, lactis milk; Greek adj. lyticus, able to loose, dissolving; Modern Latin adj. lactilytica milk digesting or dissolving.
Differs from Selenomonas ruminantium var. ruminantium in its ability to ferment lactates. Isolated from

contents of bovine rumina.
Type culture deposited in American Type Culture Collection, Washington, D. C., U.S.A.
Bryant, Marvin P. The characteristics of strains of Selenomonas isolated from bovine rumen contents. Jour. Bact. 72:162-167 (p. 165). 1956.

NEW GROUP NAMES OF VIRA

Adenovirus Enders, Bell, Dingle, Francis, Hilleman, Huebner et Payne, 1956.

Enders et al. have followed "the proposals concerning nomenclature of the Subcommittee on Viruses of the International Nomenclature Committee." They propose the group name for a "new group of viruses, affecting primarily the respiratory tract." They regard "Adenovirus" as a "meaningful, specific, and acceptable name." Rowe (1953) previously used the designation "adenoid degeneration" (AD) agent; Hilleman and Werner (1954) termed them "respiratory illness" (RI) agents; and Huebner et al. proposed "adenoidal pharyngeal conjunctival" (APC) agents or viruses.

"For the present, members of the group would be indicated by serotype numbers in accordance with the classification of Huebner et al." Twelve types have been reported from human and two from simian sources. Following are the known characteristics:

1. "Produce acute infection of respiratory and ocular mucous membranes with associated follicular enlargement of submucous lymph-anenoid tissue in these areas and also of the regional lymph glands."
2. Multiplication in tissue culture. Electron micrographs show symmetrical arrays of virus-like particles.
3. A unique antigen in this group shown by complement-fixation, is "shared by members of the family."
4. "Antigenic type specificity is demonstrable by the neutralization test."
5. "No strain has as yet produced manifest illness in commonly used laboratory animals."

The authors suggest that "Adenovirus" may be "generally employed in the interest of avoiding further confusion in the literature until ultimately a satisfactory nomenclature can be established for viruses."

Enders, John R., J. A. Bell, John H. Dingle, Thomas Francis, M. R. Hilleman, R. J. Huebner, and A. M. M. Payne. "Adenovirus"; Group name proposed for new respiratory-tract viruses. Science 124:119. 1956.

INTERNATIONAL BULLETIN OF BACTERIOLOGICAL NOMENCLATURE AND TAXONOMY
Volume 6 No. 4 October 15, 1956 pp. 157-158

ERRATA AND ADDENDUM
TO PAPER BY P. H. A. SNEATH
published in this BULLETIN, vol. 6, No. 2, pp. 65-91

Errata

p. 66, line 21: For Cromobacterium read Cromobacteriun
p. 66, line 24: For nell'acque, - read nell'acqua.-
p. 67, line 6: For alcohol, but read alcohol but
p. 67, line 14: For Bergonzini emend. read Bergonzini emend.
p. 68, line 7: For genera read generum
p. 70, line 3: For 1938 read 1948
p. 70, line 28: For 1925 read 1926
p. 70, line 30: For p. 585 read p. 855
p. 71, line 15: For 1926 p. 161, read 1926 p. 126, 1930 p. 161,
p. 71, line 18: For 1902 read 1892
p. 72, line 3: For p. 472, read p. 472).
p. 73, line 17: For coerulefaciens read Coerulefaciens
p. 73, line 27: For Beijericnkii read Beijerinckii
p. 74, line 26: For nubilis read nubilus
p. 74, line 29: For 1920 p. 755 read 1920 (11) p. 755
p. 74, line 29: For Dudschenko read Dudtschenko
p. 74, line 30: For Cornyebacterium read Corynebacterium
p. 76, line 29: For (a) read (b)
p. 78, line 27: For Migula 1900) read (Migula 1900)
p. 80, line 13: For pH7 read pH6
p. 81, line 37: For alone read slope
p. 82, line 15: For BH_3 read NH_3
p. 83, line 10: For Ajtai, K.S.C. read Ajtai, K.S.I.
p. 83, line 21: For legensgeschiedenis read levensgeschiedenis
p. 83, At foot add Bergey, D. H., R. S. Breed, E.G.D. Murray and A. P. Hitchens. Ibid. 5th Ed. London, Bailliere, Tindall and Cox pp. 92, 93, 94. 1939.
p. 84, line 9: For Breaudat read Bréaudat
p. 84, line 27: For Raghavchari read Raghavachari
p. 84, line 39: For hujusque read hucusque
p. 85, line 1-2: For Gelatine Medium Purpurfärburg hervorufender read Gelatinemedium Purpurfärbung hervorrufender
p. 86, line 8: For __,__. read Frankland, P. F. and G. C. Frankland
p. 86, line 14: For Gieszczkiewicz read Gieszczykiewicz
p. 86, line 20: For l'etude read l'étude
p. 87, line 2: For Neerl. read Néerl.

p. 87, line 26: After über die add Therapie der Ozäna und über die
p. 87, line 27: For 1669 read 1679
p. 87, line 39: For Lecog read Lecoq
p. 88, line 5: For Lehman read Lehmann
p. 88, line 21: For bacteriologie read bactériologie
p. 88, line 31: For Trinkwasser read Trinkwässer
p. 88, After line 40 add Migula, W. Schizophyta in A. Engler and K. Prantl. Die natürlichen Pflanzenfamilien. Leipzic, Engelmann. I Teil, 1a Abteilung (129 Leiferung, pp. 1-44). p. 29. 1895.
p. 88, line 42: After 941, add 943,
p. 89, line 2: For Nemmich read Nemnich
p. 89, line 21: For Leitungwassers read Leitungswassers
p. 89, line 40: For a l'etat read a l'état
p. 89, line 41: For abcés read abces
p. 90, line 5: For Heft 2 read 1 Heft 2
p. 90, line 7: For Halfte read Hälfte
p. 90, line 19: For Leitungswasser read Leitungswässer
p. 90, After line 28 add Voges, O. Über Einige im Wasser vorkommende Pigmentbakterien. Zentr. Bakt. 14:301-315, 1893.
p. 90, line 29: For Voges, H. M. read Ward, H. M.
p. 91, lines 6 and 10: For Nutzwasser read Nutzwässer
p. 91, line 13: For Separat-Abdruck. 1894. read Separat-Abdruck (1894). 1893.
p. 91, line 14: After Botanik add Ed. by A. Schenk, 3 (1884) (Encyclopaedie der Naturwissenschaften,

Addendum

p. 90, line 13: For (in press) read 15:70-98.

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